Thus, the results of the work indicate that during the implantation of silicon dioxide by Re ions, a special type of oxygen-deficient defects modified by rhenium occurs. Subsequent annealing of samples allows one to additionally change the properties of modified centers and to regulate their concentration. This approach allows you to manage the properties of materials and can be useful for change of specialized attributes of radiation detectors.

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INVESTIGATION OF PIEZOELECTIC AND ELASTIC PROPERTIES OF DIPHENYLALANINE MICROTUBES AFTER LYOPHILIC DRYING

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Self-assembled microtubes of diphenylalanine ($C_{18}H_{20}N_2O_3$, FF) are promising materials for biocompatible elements of new medical equipment [1], due to its outstanding piezoelectric properties [2, 3] comparable to those observed in lithium niobate [4]. This feature may be attributed to water molecules remaining inside the nanochannels after the self-assembly [5] and stabilizing its structure. However, the effect of water on the nanotubes' physical properties is still poorly understood.

Here we investigated the effect of water concentration on piezoelectric response and Young's moduli of FF microtubes. The microtubes were grown from FF powder (Bachem AG, Switzerland) dissolved in mixture of 1,1,1,3,3,3-Hexafluoro-2-propanol and water [2]. The water content in the microtubes was determined by previously described method [6] using confocal Raman microscope Alpha 300AR (WITec, Germany). The variation of water content was done by freeze dryer system Alpha 2-4 LSC (Martin Christ, Germany). The piezoelectric coefficient and local Young's moduli were measured using scanning probe microscope MFP-3D (Asylum, USA) and nano-hardness tester NanoScan-4D (FSBI TISNCM, Russia), respectively.

Initial FF microtubes possess a bimodal distribution of transversal Young's modulus with characteristic values of 10 GPa and 25 GPa. Lyophilic drying for 3h leads to decrease of water concentration and unimodal distribution of the Young's modulus with characteristic value of E=5,0±0,9 GPa. The piezoelectric coefficient d_{15} after drying decreases at about 55% down to 20 pm/V. Following two weeks storage of microtubes in humid atmosphere (RH about 100%) led to recovering a distribution of Young's modulus with characteristic values close to the initial values, but the piezoelectric coefficient remained 20 pm/V. Thus, lyophilic drying is a convenient soft tool for modification the physical properties of FF microtubes.

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